WHAT IS CLAIMED IS:

1. A method for chemically decontaminating radioactive material, the method comprising:

reducing-dissolving step for setting surface of radioactive material in contact with reducing decontamination liquid including mono-carboxylic acid and di-carboxylic acid as dissolvent; and

oxidizing-dissolving step for setting the surface of the radioactive material in contact with oxidizing decontamination liquid including oxidizer.

2. The method according to Claim 1, wherein: the radioactive material includes stainless steel; and

the reducing dissolving step includes lowering potential of the radioactive material to a corrosion region of stainless steel.

- 3. The method according to Claim 1, comprising a plurality of repeated pairs of steps, each pair including the reducing dissolving step and the oxidizing dissolving step.
- 4. The method according to Claim 1, wherein: the mono-carboxylic acid includes formic acid, and the

di-carboxylic acid includes oxalic acid.

- 5. The method according to Claim 1, wherein mole fraction of the formic acid in the decontamination liquid is 0.9 or more.
- 6. The method according to Claim 1, wherein the oxidizer includes at least one selected from a group of ozone, permanganic acid and permanganate.
- 7. The method according to Claim 1, further comprising separating and removing Fe^{2+} ions and Fe^{3+} ions, which have eluted into the reducing decontamination liquid, by cation resins.
- 8. The method according to Claim 1, further comprising:

decomposing the mono-carboxylic acid by hydrogen peroxide solution; and

decomposing the di-carboxylic acid into carbon dioxide and water by the oxidizing decontamination liquid.

9. A system for chemically decontaminating radioactive material which forms a passage for liquid to flow through, the system comprising:

- a circulation loop connected to the passage for circulating the decontamination liquid, the circulation loop having:
- a decontamination agent feeder for feeding mono-carboxylic acid and di-carboxylic to the decontamination liquid;
- a hydrogen peroxide feeder for feeding hydrogen peroxide to the decontamination liquid;

an ion exchanger for separating and removing metal ions in the decontamination liquid; and

an ozonizer for injecting ozone into the decontamination liquid.

- 10. A system for chemically decontaminating radioactive material, the system comprising:
- a decontamination tank for containing radioactive material and decontamination liquid;
- a direct current power source for providing potential between the radioactive material and an anode; and
- a circulation loop connected to the tank for circulating the decontamination liquid, the circulation loop having:
- a decontamination agent feeder for feeding mono-carboxylic acid and di-carboxylic acid into the decontamination liquid;

a hydrogen peroxide feeder for feeding hydrogen peroxide into the decontamination liquid;

an ion exchanger for separating and removing metal ions in the decontamination liquid; and

an ozonizer for injecting ozone into the decontamination liquid.

11. The system according to Claim 10, further comprising:

an electric insulating plate disposed in the decontamination tank; and

a support for supporting the radioactive material, the support being disposed on the electric insulating plate and being made from corrosion resistant metal.